TAXONOMIC STATUS OF *KOBRESIA CURVATA* AND *KOBRESIA FRAGILIS* (CYPERACEAE)

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ABSTRACT

Critical examination of the type specimens of *K. curvata* (isolectotype, CAL) and *K. fragilis* (isotype, CAL) reveals the two taxa are morphologically distinct and should be regarded as distinct species. Noltie (1993) merged *K. curvata* under the *K. fragilis* based on similarities in inflorescence branching. Based on micro-morphotaxonomic characters, scanning electron microscopy studies and field survey of *Kobresia* in Sikkim, *Kobresia curvata* and *K. fragilis* should be considered as distinct species.

RESUMEN

El examen crítico de los tipos de *K. curvata* (isolectotipo, CAL) y *K. fragilis* (isotipo, CAL) revela que los dos taxa son distintos mofológicamente y deben tratarse como especies distintas. Noltie (1993) Incluyó *K. curvata* en *K. fragilis* basándose en similitudes de la ramificación de la inflorescencia. Basándonos en caracteres micro-morfotaxonómicos, estudios de microscopio electrónico de barrido y observaciones de campo de *Kobresia* en Sikkim, *Kobresia curvata* y *K. fragilis* deben considerarse especies distintas.

Boott (1858:2) described *Carex curvata* as a new species from Sikkim. Unfortunately, the name was illegitimate when published (non Knaf 1847) (McNeill 2012; Art. 53.1). Clarke (1908) transferred *C. curvata* to the genus *Kobresia* and thus published *K. curvata* C.B. Clarke as a new name. Perhaps unaware of Clarke's (1908) publication, Kükenthal (1909) also published the same new name *K. curvata* (Boott) Kük., which is treated as an isonym (McNeill 2012; Art. 6, Note 2).

Within the protologue of *Carex curvata*, Boott (1858:2) mentioned the specimen "HAB. in Himalaya Orientali alpine ad Sikkim, alt. 12,000–14,000 ped. (graminosis), *J.D. Hooker s.n.*" Noltie (1993) lectotypified the name *Carex curvata* Boott on the basis of J.D. Hooker's specimens collected from Tungu (Thangu) & Lachen, localities of Sikkim. One specimen of J.D. Hooker (bearing same data as the type) deposited in CAL is very similar to the drawing (t.5) of Boott (1858): it is an isolectotype of *Carex curvata* Boott.

Clarke (1903) provided the following type information for *Kobresia fragilis*: "Szechuen: Tongolo in Kiala (*Soulie* 731). Herb. Kew." One of the duplicate specimens (det. by C.B. Clarke as "n. sp.") bearing the same locality and collection number is deposited in CAL and is the isotype of *Kobresia fragilis*. Based on this type, Kükenthal (1904) published *Schoenoxiphium caricinum* Kük., a superfluous illegitimate name (McNeill 2012; Art. 52.2 (a)). Subsequently, Clarke (1908) transferred *K. fragilis* to *Schoenoxiphium* and made the new combination *S. fragile*.

In his study of the type specimens of *Kobresia curvata* and *K. fragilis*, Noltie (1993) concluded that the inflorescence branches are similar; he mentioned that, except for the curvature of the stem, the type of *K. curvata* is similar to the type of *K. fragilis*, and suggested the curvature of the stem may result from grazing and trampling. Thus, Noltie treated *K. curvata* as a synonym of *K. fragilis* without mentioning any micro-morphological characters. Srivastava (1996) treated *Kobresia curvata* as a separate taxon in *Flora of Sikkim*. During our field survey of North & East Sikkim, we found *K. curvata* with its typical curved stem on hilly slopes (3500–4000 m), where grazing is impossible. Subsequently, we (present authors) critically examined specimens of these species and type specimens both. Our analysis of the micro-morphological characters revealed that similarity in the external appearance of these species is superficial, and we conclude that the two species are distinct (as depicted in Table 1, Fig. 3).

TABLE 1. Comparison of *K. curvata* C.B. Clarke and *K. fragilis* C.B. Clarke based on the study of the type material.

Characters	*K. curvata*	*K. fragilis*
Culm	Culm curved; base covered with pale brown prominent leaf sheaths	Culm erect; base covered with grayish yellow not prominent leaf sheaths
Inflorescence	Linear-oblong, curved; branches overlapping	Linear, never curved; branches not overlapping
Glume	Glumes of carpellate spikelet aristate or awned, margin pale green	Glumes of carpellate spikelet short mucronate to obtuse, margin hyaline
Prophyll	Oblong-ovate, yellowish brown without any red spots; opening from apex to middle	Utriculate, yellowish-brown in color with prominent red spots; open only at the apex
Racheola	Racheola exserted from prophyll, margin scabrid, longer than style, binerved; nerve brown	Racheola included in the prophyll, margin glabrous, shorter than style, binerved; nerve green
Nut surface (SEM study)	Reticulate, areole without raised, central silica body	Reticulate, areole with raised, central silica body

TAXONOMIC TREATMENT

Kobresia fragilis C.B. Clarke, J. Linn. Soc. 36:267. 1903. (**Figs. 1, 3**). *Schoenoxiphium caricinum* Kük., Bull. Herb. Boiss. 4(1):49. 1904, nom. superfl. & illegit.; *S. fragile* (C.B. Clarke) C.B. Clarke, Bull. Misc. Inform. Kew, Addit. Ser. 8:67. 1908. TYPE: THIBET ORIENTALI: Tongolo (Principauté de Kiala), 1893, *Soulie 731* (HOLOTYPE: K; ISOTYPE: CAL, acc. no. 512696!)

Perennial herbs. **Culms** erect, 13–31 × 0.08–0.1 cm (excluding inflorescence), trigonous, slender, smooth. **Leaves** basal and sub-basal, 6.6–10 × 0.1 cm, shorter than culm; lamina filiform, involute, keeled, margin scabrid; basal sheaths grayish yellow, not prominent. **Inflorescence** spicate, linear-oblong, 2.6–3 × 0.3–0.5 cm (excluding awn of proximal glume), yellowish green, axis triquetrous, lateral spikes 4–7, non-overlapping. **Spikes** linear, 2.5–4.5 × 1–1.5 mm, proximal spikelets carpellate, 3–5; distal spikelets staminate, 1–3. **Proximal glume** with clasping base, equaling or exceeding the inflorescence, ca. 4.5 cm long (including awn); awn up to 3–3.5 cm long, margin scabrid. **Carpellate spikelets** ovate to ovate-oblong, ca. 3–4 × 1 mm. **Glumes** of the carpellate spikelets ovate, aristate (awned), ca. 4 × 1 mm (including awn); awn slightly scabrid; yellowish brown, margin hyaline, nerve 1, green. **Prophylls** utriculate, ca. 3 × 1 mm, 2-keeled; keels scabrid; yellowish-brown in color with prominent red spots, open only at the apex. **Racheola** ca. 1.5 mm, included in the prophyll, margin glabrous, shorter than style, binerved; nerves green. **Gynoecium** ca. 3 mm long; ovary ca. 2 mm long, oblanceolate; style ca. 1 mm long; stigmas 3. **Staminate spikelet**s lanceolate, 2–3 × 0.5 mm, brown in color; stamens 3. **Nuts** oblong, trigonous, ca. 2 mm, grayish-yellow; appearing smooth at 60× magnification, with SEM at 1000× magnification surface reticulate, areoles with raised, central silica body.

Flowering & Fruiting.—July–Sept.

Distribution.—BHUTAN: Bumthang (above Gortsam) and Mongar (Sengor) districts, Thimphu (Pajoding above Ragyo, mountain E of Thimphu). INDIA: Sikkim (Deosa, Dzongri, Jamlinghang to Bikbari, Lachen, Karponang, Kyanglasha, Mon Lapcha, Nathula, Tsomgo, Tungu). TIBET.

Specimens examined: **INDIA. Sikkim. North Sikkim:** Changu Lake, 3640 m, 8 Jul 1996, *G.P. Sinha & D.G. Long et al. 17737* (BSHC); Yumthang, 3520 m, 13 Jul 1996, *G.P. Sinha & D.G. Long et al. 17822* (BSHC). **TIBET:** Tongolo (Principauté de Kiala), 1893, *Soulie 731* (isotype, CAL, acc. no. 512696!, holotype, K).

Kobresia curvata C.B. Clarke, Kew Bull. Addit. Ser. 8:68. 1908. (**Figs. 2, 3**). *Carex curvata* Boott, Ill. Gen. Carex 1:2, t.5. 1858, non Knaf, 1847. *Kobresia curvata* (Boott) Kük. in A. Engler, Pflanzenr. IV. 20 (Heft 38):48. 1909, isonym. TYPE: INDIA: Sikkim, 12,000–13,000 ft, *J.D. Hooker s.n.* (LECTOTYPE, designated by Noltie 1993): K!, bottom right hand specimen; ISOLECTOTYPE: CAL!).

Perennial herbs. **Culms** curved, 3–4.5 × 0.08–0.1 cm (excluding inflorescence), proximally trigonous, striate. **Leaves** basal, 2.2–6.1 × 0.05–0.1 cm, equaling or sometimes exceeding the culm; lamina filiform, convolute, curved as culm, margin scabrid; basal sheath pale brown, prominent. **Inflorescence** spicate, linear or linear-oblong, 1.2–2.7 × 0.25–0.4 cm (excluding awn of proximal glume), curved, yellowish-green, axis triquetrous; lateral spikes 3–6, overlapping. **Spikes** oblong or slightly ovoid, 4–7 × 2–3 mm; proximal spikelets carpellate, 4–7; distal spikelets staminate, 2–4. **Proximal glumes** leafy, exceeding the inflorescence, ca. 7 mm (including

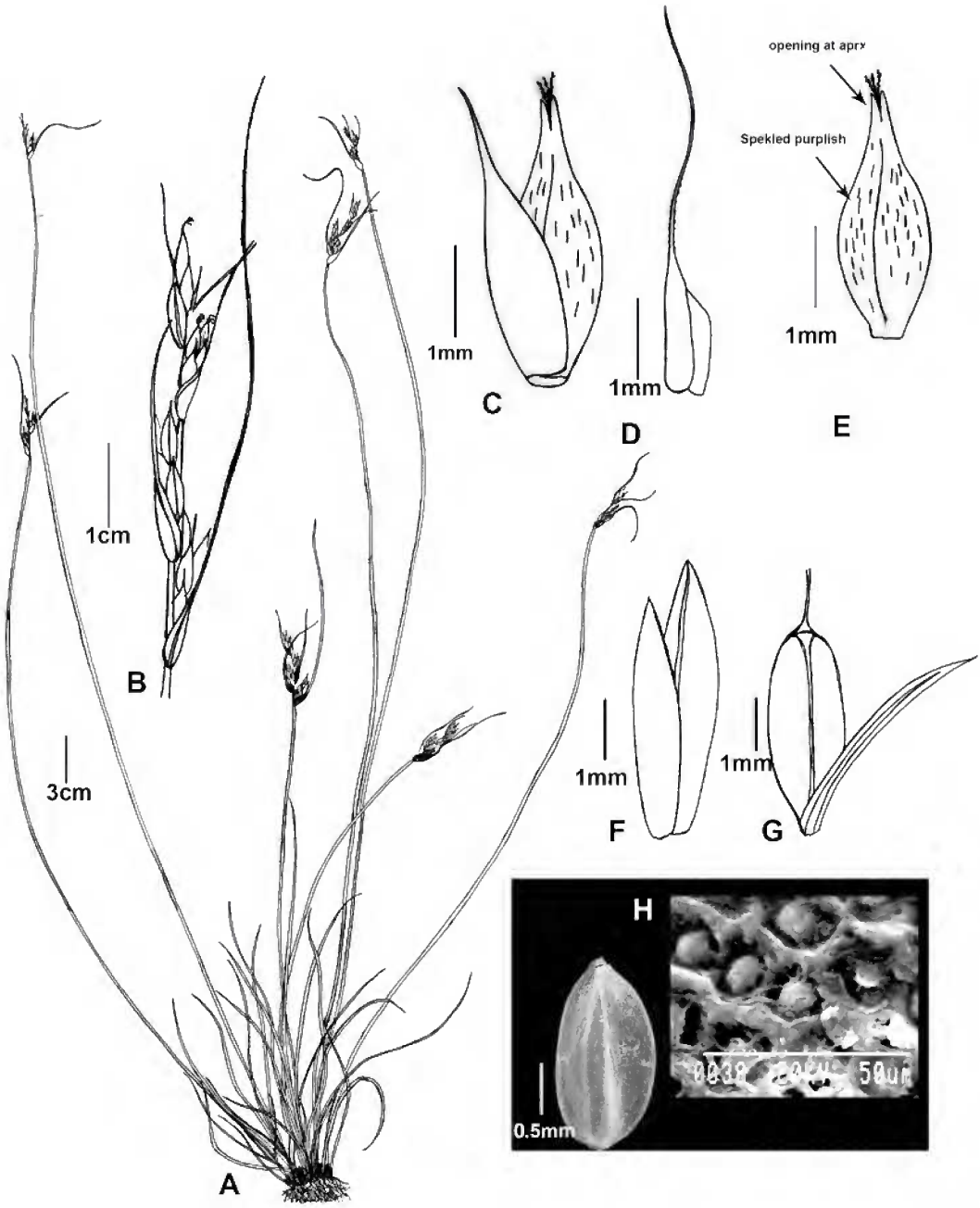

Fig. 1. *Kobresia fragilis* C.B. Clarke. **A.** Habit. **B.** Spike. **C.** Carpellate glume. **D.** Proximal glume. **E.** Prophyll. **F.** Staminate spikelet. **G.** Gynoecium with racheola. **H.** Nut surface under SEM.

awn); awn up to 4 cm long, curved, scabrid. **Carpellate spikelets** ovate, ca. 2.5–3 × 1.2 mm, yellowish. **Glumes** of the carpellate spikelets ovate ca. 2 × 1.5 mm, short-mucronate or obtuse, glabrous, yellowish brown, margin pale green, nerve 1, green. **Prophylls** oblong-ovate, ca. 2.5–3 × 1–1.2 mm, 2-keeled; keels scabrid; yellowish

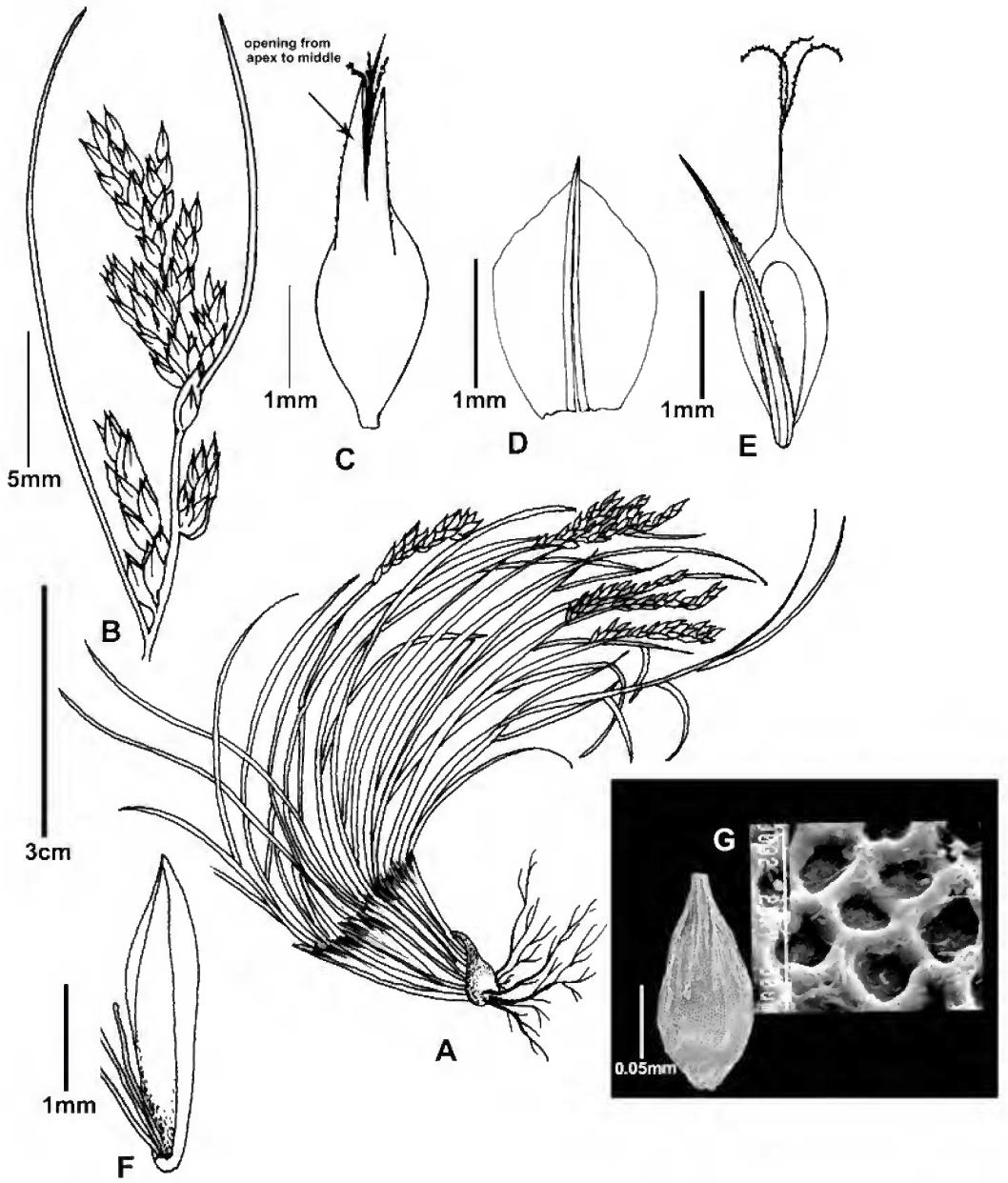

Fig. 2. *Kobresia curvata* C.B. Clarke. **A.** Habit. **B.** Spike. **C.** Carpellate spikelet. **D.** Carpellate glume. **E.** Gynoecium with racheola. **F.** Staminate spikelet. **G.** Nut surface under SEM.

brown, opening from apex to middle. **Racheola** ca. 3 mm long, exserted from prophyll, linear, as long as or longer than prophyll, margin scabrid, binerved; nerve brown. **Gynoecium** 3–3.5 mm long; ovary 2 × 0.75 mm, ovate- elliptic; style 0.5–1 mm long; stigmas 3. **Staminate spikelets** oblong, 2.5–3 × 1 mm, yellow in color, margin hyaline; stamens 3. **Nuts** elliptic to ovoid, trigonous, ca. 1.5 × 1 mm, reddish brown, appearing smooth at 60× magnification, with SEM at 1000× magnification surface reticulate, areoles without central silica body.

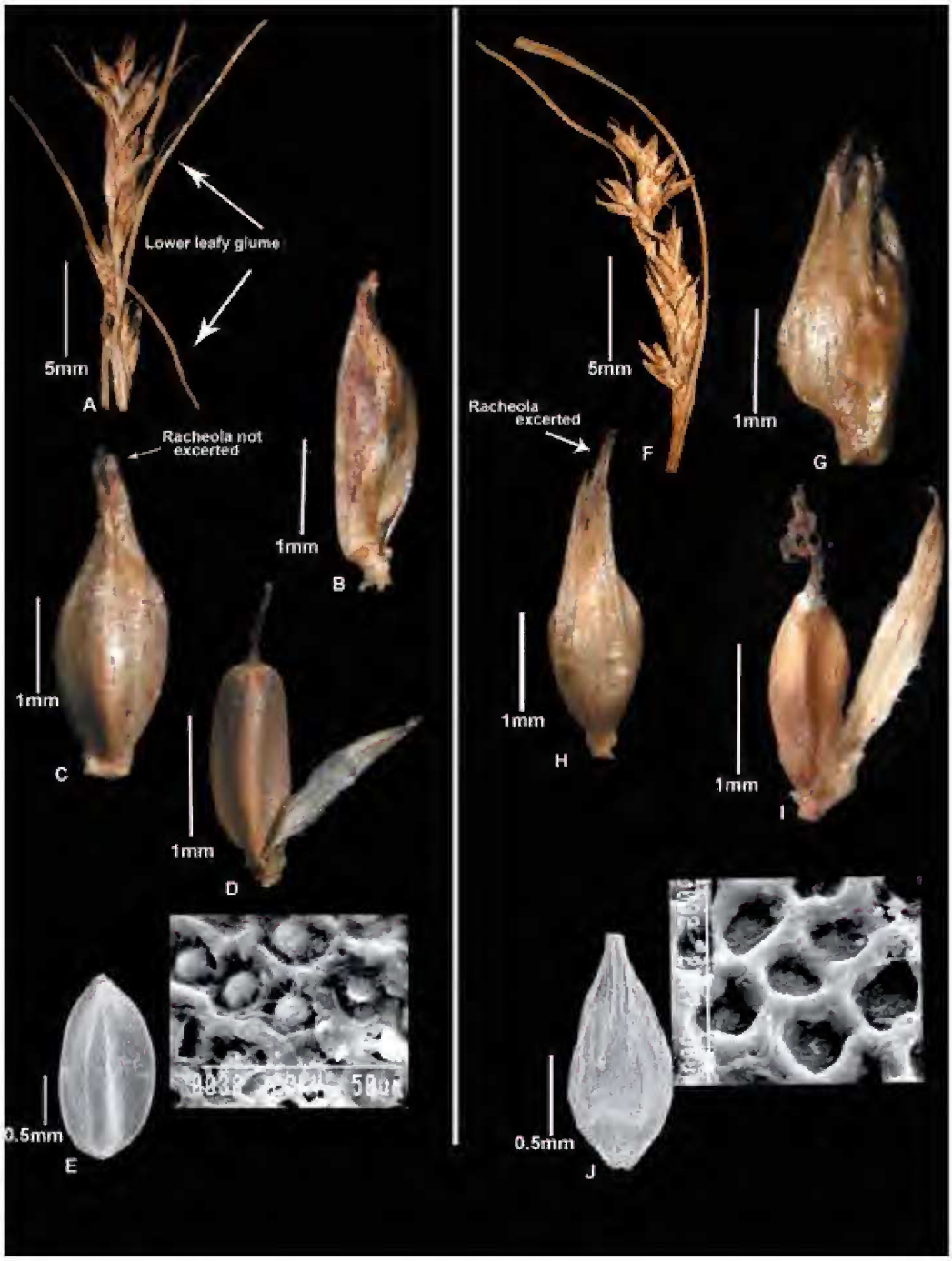

Fig. 3. A–E. *Kobresia fragilis*. **A.** Inflorescence. **B.** Carpellate spikelet. **C.** Prophyll with gynoecium. **D.** Gynoecium with racheola. **E.** Nut & nut surface under SEM. **F–J.** Kobresia curvata. **F.** Inflorescence. **G.** Carpellate spikelet. **H.** Prophyll with gynoecium. **I.** Gynoecium with racheola. **J.** Nut surface under SEM.

Flowering & Fruiting.—July–Aug.

Distribution.—Eastern Himalaya; INDIA: Sikkim (Changu, Karponang, Katao, Kupup, Kyangosla, Lachen, Lachung, Nathula, Thangu, Tsomgo), 3600–4000 m.

Specimens examined: **INDIA. SIKKIM:** Himalaya, Cho-le-la, Jul 1879, *G. King s.n.* (CAL). **East Sikkim:** 6 km above from Zuluk, 3230 m, N27°15. 431'E 088°47. 418', 27 Jul 2012, *Bikash Jana 53134* (CAL); Kupup, 4115 m, N 27°18. 908' E 088°50. 158', 28 Jul 2012, *Bikash Jana 53169* (CAL). **North Sikkim:** Katao, Kala Pahar, 28 Jul 1989, *N.R. Mondal 10133* (BSHC); Lachen, 2550 m, 07 Jun 1999, *D. Maiy 21327* (BSHC, 2 specimens); Thangu, 17 Aug 1989, *R.C.Srivastava 12289* (BSHC); Thangu, 17 Aug 1989, *R.C. Srivastava 10206* (BSHC). **WEST BENGAL:** Darjeeling district, *A.B. Chowdhury 53* (CAL).

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